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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/082,576

02/25/2002

Junichi Aoyama

09792909-5347

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10/16/2003

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 10/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/082,576

Applicant(s)

AOYAMA, JUNICHI

Examiner

Shouxiang Hu

Art Unit

2811

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) 20-40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 20-40 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 7.

Claim Objections

2. Claims 1-19 are objected to because of the following informalities and/or defects:

In claims 1 and 10, the term of "a groove formed on an insulation film" should read as: --a groove formed in an insulation film--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-19 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for forming a connection pillar self-aligned with the underlying first conductive layer only along the width direction with the help of a growth suppression mask layer, does not reasonably provide enablement for forming a connection pillar self-aligned with the underlying first conductive layer along any other

Art Unit: 2811

direction and/or without using any growth mask. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. As shown in Figs. 2-8 of the instant disclosure, the resulting connection pillar (5) is self-aligned with the underlying first conductive layer (3) only along the width direction. The other dimension of the pillar is defined with the help of the growth suppression mask layer (4), which itself naturally functions as a growth guide, as it stops the growth of the pillar in at least one of the lateral dimensions.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-2, 4, 6 and 9, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(b) as being anticipated by Sugai (JP 8-339973, 12/1996).

Sugai discloses a semiconductor device (Figs. 1 and 2), comprising: a second conductive layer (8, Al); a connection pillar (6; Al); and a first conductive layer (3) embedded in a groove formed in an insulation film (at least the bottom portion of the insulation layer 4), wherein at least the vertical edges of the connection pillar are aligned along a direction same as that of the vertical walls of the first conductive layer;

Art Unit: 2811

and/or, at least the bottom surface the connection pillar is aligned with a top surface of the first conductive layer.

And, it is noted that the recited limitations of "self-aligned" and "without any usage of a growth guide" are regarded as process limitations; however, these would not carry patentable weight in the claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

7. Claims 1, 3, 5-10, 12 and 14-19, insofar as being in compliance with 35 U.S.C. 112, are rejected or further rejected under 35 U.S.C. 102(b) as being anticipated by Kubokoya (JP 8-213391, 8/1996).

Kubokoya discloses a semiconductor device (Figs. 1-3), comprising: a second conductive layer (an upper portion of 105, Al alloy); a connection pillar (a lower portion of 105; Al alloy); and a first conductive layer (103, Al alloy) embedded in a groove formed in an insulation film (the lower portion of 1041 or 104), wherein at least the bottom surface the connection pillar is aligned with a top surface of the first conductive layer; and at least a top portion of the insulation layer (1041 or 104) has an opening with a width wider than a bottom width of the first conductive layer and naturally functions as a growth suppression film, as it defines the lateral dimensions of the connection pillar therein.

And, it is noted that the recited limitations of "self-aligned" and/or "without any usage of a growth guide" are regarded as process limitations; however, these would not

Art Unit: 2811

carry patentable weight in the claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claims 7, 8, 16 and 17, the first conductive layer and the connection pillar in Kubokoya are both made of an Al alloy that naturally has a face-centered cubic structure; and thus the first conductive layer and connection pillar therein both naturally have a <111> preferred orientation.

Regarding claim 18, it is noted that Kubokoya further teaches that the entire insulation layer (1041) can be made of film composed of silicon nitride.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 2, 4, 11 and 13, insofar as being in compliance with 35 U.S.C. 112, are rejected or further rejected under 35 U.S.C. 103(a) as being unpatentable over Kubokoya (JP 8-213391, 8/1996) in view of Toyoda (US 6,215,189).

The disclosure of Kubokoya is discussed as applied to claims 1, 3, 5-10, 12 and 14-19 above.

Although Kubokoya does not expressly disclose that the first conductive layer and/or the connection pillar can also be made of Al, one of ordinary skill in the art would readily recognized that Al is one of the few most commonly used interconnection

Art Unit: 2811

materials in the art for its good electrical and mechanical properties, as evidenced in Toyoda (see col. 6, lines 8-12).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the Al interconnection material of Toyoda into the device of Kubokoya, so that semiconductor device with good interconnections would be obtained.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References B-D are cited as being related to an interlayer interconnection structure.

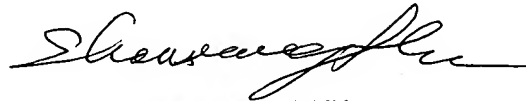
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Art Unit: 2811

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH
October 1, 2003

A handwritten signature in black ink, appearing to read 'Shouxiang Hu', written in a cursive style.

SHOUXIANG HU
PRIMARY EXAMINER